Fund flows, manager change and performance persistence

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Abstract

Most empirical studies suggest that mutual funds do not persistently outperform an appropriate benchmark in the long run. We analyze this lack of persistence in terms of two equilibrating mechanisms: fund flows and manager changes. Using data on actively managed U.S. equity mutual funds, we find that if neither mechanism is operating, winner funds (top-decile ranked in previous year) continue to significantly outperform loser funds (bottom-decile ranked in previous year) by 4.08 percentage points per annum. However, the difference between previous winner and loser funds declines to zero within one year if the two mechanisms are acting together. Thus, mutual fund out- and underperformance is unlikely to persist in well-functioning markets.

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Keywords: Mutual funds, performance persistence, fund flows, manager changes.

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1. Introduction

It is widely recognized that equity mutual fund performance does not persist in the long term, even though some studies indicate some short-term persistence.[1] Understanding the reasons for this may allow us to differentiate between fund manager luck and fund manager skill. A lack of performance persistence may be evidence of luck in previous periods or may be due to the operation of "equilibrating mechanisms" (Berk and Green, 2004; p. 1,271) which ensure that future expected excess returns of mutual funds are zero, even in the presence of differential fund manager abilities. The two main mechanisms are fund flows and manager turnover.

The fund flow mechanism was proposed by Berk and Green (2004) who argued that even with skilled managers, monies flowing into previously successful funds, and out from underperforming funds, ensures mutual fund market equilibrium with zero expected abnormal returns. Due to decreasing returns to scale in active fund management, the growth in fund size of recent winner funds cause their performance to deteriorate, while loser-fund performance benefits from withdrawals that force managers to re-optimize their portfolios.

With respect to the manager turnover mechanism, Khorana (1996) reports an inverse relationship between manager changes and fund performance. Star fund managers are able to extract a larger share of the higher fee income by either moving to a larger fund within the same organization or to another fund family (Hu et al., 2000), or being hired away to a hedge fund (Kostovetsky, 2010).[2] Underperforming funds may replace their managers through some disciplining device: such managers may be demoted to run smaller funds in the same fund

[1] See, e.g., Hendricks et al. (1993), Carhart (1997) and Pastor and Stambaugh (2002) for long-term performance persistence, and Bollen and Busse (2005), Busse and Irvine (2006) and Huij and Verbeek (2007) for short-term performance persistence. Busse et al. (2010) document a similar pattern for institutional funds.

[2] Deuskar et al. (2011) find that many mutual funds are able to retain out-performing managers even when faced with competition from the hedge fund industry, although any increase in salaries may be reflected in higher management fees and lower net returns to investors

family or fired after a sustained period of poor performance. Dangl et al. (2008) develop a model of the mutual fund industry which combines fund flows and manager changes for underperforming funds. Both winner and loser funds faced with a manager departure need to hire a replacement manager from the pool of available fund managers with unconditionally average skills. Such average skills will be lower than the recently departed star manager, but higher than the fired loser-fund manager.

We investigate how far these two mechanisms explain mean reversion in mutual fund performance and whether they interact as substitutes or complements. If they are complements, then they should be more effective in eliminating performance persistence when operating together. If they are substitutes, then the incremental effect of one mechanism, conditional on the other operating, should be close to zero. In fact, we find that the two mechanisms act as complements for both past outperforming (winner) and past underperforming (loser) funds, based on a sample of 6,207 actively managed U.S. equity mutual funds over the period from 1992 to 2011, with fund flows acting as the dominant mechanism, and manager changes reinforcing the fund-flow effect.

For winner funds, we find those experiencing both of the equilibrating mechanisms – having relatively high net inflows and a manager change – underperform those in which neither mechanism operates by 0.19 percentage points per month (2.28 percentage points per annum)[3] on a risk-adjusted basis in the following year. Of this, 0.15 percentage points per month is accounted for by fund flows alone and just 0.01 percentage points per month by manager change

[3] We report fund performance in percent/ percentage points per month throughout the paper as our analysis is based on monthly fund returns. However, for comparison with other studies, we add percent/ percentage points per annum in parentheses in some sections.

alone, confirming that, for winner funds, the two mechanisms are complementary, but with fund flows having a much bigger impact.

For loser funds, as predicted by Dangl et al. (2008), we also detect a strong interaction effect between both mechanisms. Manager changes, interpreted as an "internal governance" device, and outflows, treated as an "external governance" device, reinforce each other and the combined effect is a 0.16 percentage points per month (1.92 percentage points per annum) higher risk-adjusted performance for loser funds experiencing both forms of governance relative to funds experiencing neither. Of this, 0.10 percentage points per month is due to fund flows and 0.03 percentage points per month due to manager change, also confirming – but this time for loser funds – that the two mechanisms are complementary, again with fund flows dominating.

We go on to examine the spread in subsequent 12-month performance between winner and loser funds, and we identify an unconditional spread of 0.22 percentage points per month (2.64 percentage points per annum) in alphas, similar to the results in Carhart (1997). By conditioning only on winner and loser funds that do not experience either of the equilibrating mechanisms, our results produce a highly significant winner-minus-loser spread of 0.34 percentage points per month (4.08 percentage points per annum) in the subsequent year. In contrast, by conditioning on winner and loser funds experiencing both mechanisms, the corresponding spread narrows to an insignificant -0.02 percentage points per month (-0.24 percentage points per annum), implying that the substantial difference in alphas of 1.71 percentage points per month (20.52 percentage points per annum) between winner and loser funds in the portfolio formation period is completely eliminated in the evaluation period. These results indicate that a combination of both fund flows and manager changes explain the lack of performance persistence in mutual fund performance, and that performance persists when funds

are not exposed to at least one mechanism. Further, we find evidence of time-varying predictability in fund performance, with the poor performance of loser funds being more likely to persist in bear markets.

The rest of the paper proceeds as follows. The next section presents a review of the literature and is followed by a section developing our hypotheses. In section 4, we describe our data set and explain our research methodology. Our results are discussed in section 5: using ranked portfolio tests, we analyze fund flows, manager changes and their interaction for winner and loser funds separately, and then examine the spread in winner-minus-loser fund performance. We undertake some robustness tests in section 6. Section 7 concludes and discusses the implications of our findings.

2. Literature Review

Empirical support for the Berk and Green (2004) fund flows explanation is provided by Chen et al. (2004) and Yan (2008) who find that transaction costs are positively correlated with both fund size and the degree of illiquidity of the investment strategy, and that small funds outperform large funds. However, this is only an indirect test of the Berk-Green hypothesis. Although the finding that small funds outperform large funds is consistent with decreasing returns to scale, differences in fund size are the result of both external growth, due to the net inflows accumulated throughout a fund's full history since inception, and internal growth, due to differential performance. Sirri and Tufano (1998) and Lynch and Musto (2003) document that past outperformance triggers large inflows, but that investors in poorly performing funds typically fail to withdraw their investments. Explanations for such behavior include: the anticipation of a strategy change by the incumbent manager, the firing of a poorly performing manager, a disposition effect (Shefrin and Statman, 1985; Singal and Xu, 2011), and investor

inertia (Berk and Tonks, 2007). Edelen (1999), Alexander et al. (2007) and Dubofsky (2010) argue that excessive inflows or outflows encourage liquidity-motivated rather than valuation-motivated trading by the managers subject to these flows and induce immediate transaction costs, both of which are detrimental to short-run fund performance. Wermers (2000) reports that inflows and outflows lead to excessive cash holdings which contribute to fund underperformance by 0.7 percent per year. Rakowski (2010) documents that funds with more volatile flows underperform those with less volatile flows, which implies that outflows can be as harmful for future performance as inflows, a finding that is incompatible with Berk and Green's (2004) conjecture that underperforming funds benefit from withdrawals. Even worse, large outflows can result in liquidity-motivated fire sales which distort fund performance and impose even higher costs on loser funds (Coval and Stafford, 2007). Thus, there may be asymmetric effects of fund flows on loser funds and winner funds.

A number of papers document an inverse relationship between fund performance and manager changes (Khorana, 1996; Chevalier and Ellison, 1999; Gallagher and Nadarajah, 2004; Kostovetsky and Warner, 2015). Khorana (2001) reports that a manager change results in a deterioration in the performance of outperforming funds, and an improvement in the performance of recently underperforming funds. The Dangl et al. (2008) model of underperforming funds predicts – for most sets of parameter values – that there will be capital outflows pre-replacement if there is underperformance by the incumbent manager, which subsequently reverts after the manager is replaced. Kostovetsky and Warner (2015) argue that fund flows and manager changes are often connected, with fund flows increasing after a manager change.

3. Hypotheses Development

Our aim is to explain empirically the lack of persistence in mutual fund returns, and test the prediction that fund flows, fund manager changes or a combination of these two mechanisms can explain the documented mean reversion in mutual fund performance. We use performance-ranked portfolio strategies to first identify the lack of persistence in the outperforming and underperforming groups of funds, and then test whether sub-groups of winner and loser portfolios formed on the basis of fund flows and manager changes also display no persistence.

These mechanisms may operate in different ways for winner and loser funds, and therefore we analyze each group separately in Section 5. Our approach is to condition the sample of mutual funds by the type of mechanism – using single and double sorts – and examine whether performance persistence is absent in those sub-groups that feature high net inflows and manager changes.[4] If there is no persistence (i.e., there is mean reversion), then we will hypothesize that this is due to flows and/or manager changes;[5] with the corollary that if there is persistence (i.e., no mean reversion), the mechanisms are absent.

There are several reasons to believe that fund flows and manager changes are not independent of each other. Both mechanisms will be triggered by past performance, and the findings of Khorana (2001), that manager changes affect future fund performance, might, in part be attributable to the effect of contemporaneous fund flows – either directly or by fund flows prompting a manager change. Thus, it is important to control for this interaction. Moreover,

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[4] A concern with our approach, identified by a referee, is that the samples of funds on which these comparisons are conducted are not nested, so there is no counterfactual for the same group of funds with and without the two equilibrium forces. In order to address this concern, we report below the result of a robustness test in which we match the sample of funds in terms of a number of unconditional characteristics potentially correlated with fund flows and the firing/hiring decision and test whether the samples diverge from each other.

[5] In this case, we will observe a significant difference in the spread of raw returns (or Jensen-alphas) between sub-samples of funds with one or both mechanisms operating and sub-samples with neither mechanism working.

fund flows may have a differential effect on fund performance for new managers as compared with incumbent managers.

In order to assess these interaction effects in detail, we classify the fund-flow and manager-change mechanisms as being substitutes if the performance impact of one mechanism is smaller when the other mechanism operates simultaneously. Fund flows and manager changes are interpreted as being complements if the performance impact of one mechanism is larger when it operates jointly with the other mechanism. In those cases where the performance impact of each mechanism is the same, irrespective of whether it operates separately from or in combination with the other mechanism, the mechanisms will be classified as being independent of each other.

We propose the following hypotheses on the joint effects of fund flows and manager changes on the performance persistence of winner and loser funds:

- For winner funds experiencing high inflows, we expect a deterioration in subsequent performance, while for loser funds experiencing high outflows (i.e., low net inflows), we expect an improvement in subsequent performance.
- For winner funds with a manager change, we expect a deterioration in subsequent performance, while for loser funds with a manager change, we expect an improvement in subsequent performance.
- For funds experiencing both mechanisms, we expect either amplified (in the case of complements) or attenuated (in the case of substitutes) effects on future performance.

In the case of winner funds, fund flows and manager changes are potential substitutes, because if net inflows remain low despite superior past performance, the fund manager is in a weaker position to negotiate a higher compensation package, increasing the likelihood of her

leaving. In contrast, if the fund is subject to high net inflows, the manager may decide to stay and benefit from a larger asset base and hence higher fees and salaries. A further reason for these mechanisms being substitutes is that a newly appointed fund manager is likely to adjust the portfolio holdings towards her own preferred investment strategy. If large net inflows occur at the same time, the manager could use these inflows efficiently to adjust the portfolio weights and, by doing so, reduce the marginal negative performance impact of high net inflows.

Pollet and Wilson (2008), however, find that fund managers tend to scale up existing holdings as a response to inflows, in which case, fund flows and manager changes are complements among winner funds. Specifically, if managerial skill determines the number of "best ideas" a manager is able to generate (Cohen et al., 2010) and the newly hired manager has lower skills and hence fewer good ideas than the former manager, then the same level of inflows will have a stronger impact on lowering the performance of winner funds with a manager change than on those without.

For loser funds, Dangl et al. (2008) predicts that internal and external governance mechanisms are potential substitutes. If the manager has been replaced, investors will no longer see any reason to withdraw money and instead will remain invested, waiting for a performance reversal. Similarly, if money has flowed out, the fund management company might decide that the existing manager will be able to improve a fund's performance with the smaller asset base, consistent with the Berk-Green prediction. The manager-change mechanism operates when the fund management company fires an underperforming fund manager and performance improves under a newly appointed manager, leading to stronger mean reversion for loser funds with a manager change.

Alternatively, internal and external governance mechanisms in loser funds could reinforce each other and act as complements. If the market reacts quickly to poor past performance, the fund management company may fire a poorly performing manager in an attempt to stem outflows. Furthermore, causality could be reversed: if the disposition effect explains why many investors in poorly performing funds do not withdraw their investments, a manager replacement can serve as an attention trigger. Once investors are aware of both the manager change and the underperformance, they start withdrawing funds.[6] Cremers and Nair (2005) investigate the interaction between internal and external control mechanisms in the context of corporate governance, and examine performance differentials between companies where one or both of these mechanisms are present. Their results have implications for the incentives and penalties facing corporate managers arising from the two governance mechanisms. Our study has similar implications for fund managers. Whether the equilibrating mechanisms are substitutes or complements is an empirical question that our data set allows us to investigate.

Our final hypothesis follows naturally from the previous ones:

- The spread in performance between previous winner and loser funds will be reduced if either or both equilibrating mechanisms are operating simultaneously.

[6] There is a potential prisoners' dilemma issue here whereby investors defer withdrawing money from poorly performing funds in anticipation of a manager change, but the fund management company delays firing the poorly performing fund manager because the outflows have not materialized.

The corollary is that in the absence of fund flow and manager changes, past winners will continue to outperform past losers, and there will be some persistence in both winner and loser fund performance.[7]

4. Data and Research Methodology

4.1. DATA

Our mutual fund sample from the Center for Research in Security Prices (CRSP) starts in 1992, the first year for which reliable information on manager changes becomes available, and ends in 2011. We follow Pastor and Stambaugh (2002) and select only actively managed U.S. domestic equity funds (see Table XIV in the Appendix). We aggregate all share classes of the same fund and drop all observations prior to the initial public offer (IPO) date given by CRSP as well as funds without names to account for a potential incubation bias (Evans, 2010). Our final sample consists of 6,207 funds that existed at some time during the period from 1992 to 2011 for at least 12 consecutive months. These funds have an average fund size of 875 million USD (Table I). Fund size increased over the sample period, whereas average fees fell from 1.45 percent to 1.36 percent of assets under management.[8]

[Please insert **Table I** about here]

Monthly fund flows are constructed from the change in total net assets adjusted for internal growth from investment returns:

$$flow_{it} = TNA_{it} - TNA_{it-1}(1 + R_{it}) \quad (1)$$

[7] Persistence is, however, likely to decline over time due to the operation of what we call "natural mean reversion", discussed in detail in section 6.4.

[8] Fees are calculated as the sum of the annual expense ratio and 1/7th of the sum of the front end and back end loads. Sirri and Tufano (1998) and Barber, Odean and Zheng (2005) both assume a seven-year average holding period for mutual funds. See French (2008) for an analysis of changes in the fee structure over time.

where TNA_{it} refers to the total net assets of fund i at the end of period t and R_{it} is the return of fund i between t-1 and t, assuming that all distributions are reinvested and are net of fund expenses. On average, each fund received 2.57 million USD net inflows per month.

To obtain information on manager changes, we focus on the variable "mgr_date" in the CRSP database, instead of using the specific names of the managers.[9] This variable provides the date of the last manager change as reported by the fund management company. By using the manager date variable, we avoid any problems associated with different spellings of manager names. Furthermore, as the number of team-managed funds increased during recent years, the manager date variable has the advantage that companies only report significant changes in manager/management team that are likely to have an impact on performance (Massa et al., 2010). A total of 7,919 manager changes occurred during our sample period, which means that, on average, 15 percent of the fund managers are replaced each year.

4.2. RESEARCH METHODOLOGY

We use ranked portfolio tests (Carhart, 1997, Carpenter and Lynch, 1999, and Tonks, 2005) to investigate the hypotheses outlined in Section 3.

Funds are first ranked into equal-weighted decile portfolios based on their previous performance over rolling twelve-month periods. Then, in a second sorting of the top-decile-10 and the bottom-decile-1 portfolios, we form subgroups based on fund flows (low net inflows / high net inflows) or manager changes (with manager change / without manager change): see

[9] This variable has also been used by Lynch and Musto (2003) and Cooper et al. (2005). In theory, it shows the date that the manager leaves. However, for around 80 percent of observations, this is reported as the first of January. For the years 1992 and 1993, the variable is evenly distributed over different months. We conclude from this that the variable can only be used as an indicator of the year in which a manager change occurred. One implication of this that our data set is not sufficiently detailed to investigate the impact of the timing differences between fund flows and manager changes on subsequent fund performance. In other words, we are unable to test whether fund flows pre-date and hence possibly "cause" a manager change or vice versa. We are only able to indicate that there were changes in fund flows as well as a manager change within the same year and then assess what effect these had on a fund's subsequent performance.

Figure 1.[10] Furthermore, as we are interested in the interaction effects between both mechanisms, we also form subgroups by double sorting on fund flows and manager changes simultaneously (low with / low without and high with / high without). We analyze the performance of these subgroups of top and bottom decile portfolios and the performance of spread portfolios.

[Please insert **Figure 1** about here]

The decile portfolios are formed either (a) on the basis of each fund's alpha in the previous year or (b) on the basis of previous-year raw returns. For the first method, funds are ranked by alphas from a Carhart (1997) four-factor model estimated over the previous 12 months (the formation period), where the four common factors are the excess return above the risk-free rate on the market index (MKT_t), the returns on a size factor (SMB_t), a book-to-market factor (HML_t), and a momentum factor (MOM_t). Fund excess returns above the risk-free rate accounting for different fund styles are given by:

$$r_{it} = \alpha_i + \beta_{1i} MKT_t + \beta_{2i} SMB_t + \beta_{3i} HML_t + \beta_{4i} MOM_t + \varepsilon_{it} \quad (2)$$

To assess performance and fund flows in a timely manner, we focus on the previous 12-month horizon. Using such a short horizon to estimate alphas from a factor model is problematic on account of the low degrees of freedom available for estimating (2). Nevertheless, we are able to efficiently estimate (2) over this short horizon by applying the "empirical Bayes" adjustment

[10] In Berk and Green (2004), active management suffers from decreasing returns to scale, but it is an empirical question whether these capacity constraints are absolute or relative. Absolute capacity constraints arise once a certain threshold of absolute fund size is exceeded. Relative capacity constraints differ across investment strategies and arise after the fund receives a certain level of inflows relative to the initial fund size. We analyze both absolute and relative net inflows, but, in the presentation of our results, we concentrate on absolute flows because the results for relative fund flows are qualitatively very similar, though slightly weaker.

procedure discussed in Huij and Verbeek (2007, hereafter HV), assuming a multivariate normal prior. Let $\theta_i = (\alpha_i, \beta_{1i}, \beta_{2i}, \beta_{3i}, \beta_{4i})'$ be a vector of unknown parameters to be estimated. The cross-sectional distribution of the funds' alphas and betas is assumed to be normal, $\theta_i \sim N(\mu, \Sigma)$, where μ is a 5-dimensional vector of cross-sectional means of alphas and betas, and Σ is a 5x5 covariance matrix. Assuming the errors in (2) are distributed as $\varepsilon_{it} \sim IIN(0, \sigma_i^2)$, the posterior distribution of θ_i is also normal with expectation:

$$E(\theta_i) = \left(\frac{1}{\sigma_i^2} X_i' X_i + \Sigma^{-1}\right)^{-1} \left(\frac{1}{\sigma_i^2} X_i' X_i \hat{\theta}_i + \Sigma^{-1}\mu\right) \tag{3}$$

where X_i is the matrix of returns on the four factors plus the intercept, $\hat{\theta}_i$ is the OLS parameter estimate, and σ_i^2 is the variance of the errors in (2). The corresponding covariance matrix is given by:

$$V(\theta_i) = \left(\frac{1}{\sigma_i^2} X_i' X_i + \Sigma^{-1}\right)^{-1} \tag{4}$$

As the prior mean μ and the prior covariance matrix Σ in Equations (3) and (4), we take the cross-sectional averages of the time series OLS estimates of the coefficients of (2) and their corresponding empirical covariance matrix for all funds in the cross section of our sample in a given 12-month formation period.[11] Thus, we have the same priors for all funds in a given month. According to Equation (3), the posterior estimate of θ_i is the matrix-weighted average of the prior μ and the OLS estimate $\hat{\theta}_i$; the same holds for the posterior estimate of the covariance

[11] Specifically, we estimate time-series OLS regressions for each of the *N* funds in the data set for months 1 to 12. We average the *N* $\hat{\theta}_i$ estimates to form μ and use the empirical covariance matrix of these *N* $\hat{\theta}_i$ estimates to form Σ. We plug μ and Σ into Equations (3) and (4) to obtain the mean and variance of the posterior distribution of θ_i for month 13. We repeat this process using the observations in months 2 to 13 in order to obtain the posterior distribution in month 14. We continue until the end of our data set using these rolling windows.

matrix in Equation (4).[12] Confidence in the prior is the reciprocal of the estimation efficiency of the OLS estimate for each fund. Thus, the empirical Bayes adjustment "shrinks" any extreme parameters towards the mean of the prior, where the degree of shrinkage depends on the cross-sectional dispersion of the parameters, given by Σ. The empirical Bayes adjustment is greater, the lower the estimation efficiency of the funds' OLS parameters. The intuition is that it is less likely for a fund to generate high alphas if all other funds generate relatively low alphas during the same period. However, the posterior distribution of θ_i also takes the multivariate nature of the coefficients' inter-relationship into account: e.g., if small-cap funds tend to have positive alphas (i.e., there is a positive correlation between α_i and β_{2i} in Equation (2)), a negative OLS estimate of a small-cap fund *i*'s alpha receives a positive empirical Bayes adjustment.

This argument is similar to the methodology of Cohen et al. (2005) who, in addition, take the similarity in investment strategies into account. They attribute a higher skill level to fund managers who deliver their outperformance with a similar strategy to other skilled fund managers in comparison with managers who used a completely different strategy. The latter are classified as lucky rather than skilled. Consequently, alpha-sorting based on Bayesian four-factor alphas accounts for a risk-adjustment of the performance measure used for the ranking, corrects for different investment styles and reduces the influence of high-risk strategies on the ranking. We also compare these results with portfolio formation based on raw returns, but we

[12] HV experimented with various methods to obtain the posterior estimates, such as simple linear shrinkage, iterative Bayes, and Gibbs sampling, but found that these other methods for estimating the posterior did not improve on their empirical Bayes approach, and therefore we follow HV in adopting the same approach.

believe that, in contrast to the raw return-sorting, the Bayesian alpha-sorting provides a much more reliable way of separating skilled from unskilled but lucky fund managers.[13]

5. Empirical Results

Figure 2 demonstrates that the dynamics of mutual fund returns over time are consistent with the earlier conclusions of Carhart (1997) who reported a lack of performance persistence and a strong tendency for performance to mean revert. Specifically, the top ten percent of funds (winner funds)[14] generate average raw returns in the formation year of 1.45 percent per month which decline to 0.59 percent per month in the subsequent evaluation year. The bottom ten percent of funds (loser funds), in contrast, experience a mean reversion in raw returns from -0.36 to 0.34 percent per month. In other words, a raw return spread between winner and loser funds of 1.81 percent per month (21.72 percent per annum) in the formation year declines to 0.25 percent per month (3.00 percent per annum) in the evaluation year. Having established that performance persistence is mean reverting amongst both winner and loser funds, we now investigate how fund flows and manager changes influence these results.

[Please insert **Figure 2** about here]

5.1. WINNER FUNDS

Winner funds, on average, have a formation-period fund size of 794.0 million USD and receive 8.5 million USD of new net inflows per month (Table II). They grow to an average size of 1,037.0 million USD in the evaluation period due to internal (investment performance) and

[13]The average fund flows in the deciles and subgroups are not qualitatively different when we form portfolio deciles based on raw returns instead of the Bayesian four-factor alphas. Since raw returns are more relevant to retail investors who are unlikely to calculate four-factor alphas, it is comforting to know that average fund flows in the deciles and subgroups are not sensitive to the sorting criteria. The subgroups should not be affected as we explicitly use fund flows as a second sorting mechanism.

[14] Determined by having the highest 10 percent of Bayesian four-factor alphas.

external (fund flows) growth. Conditioning on fund flows, we separate winner funds into a subgroup with "low absolute net inflows" during the formation period, averaging -5.6 million USD per month, and a subgroup with "high absolute net inflows", averaging 22.6 million USD per month, a significant difference of 28.2 million USD. The fraction of managers leaving winner funds is the same for both subgroups at 17 percent,[15] but winner funds with low absolute net inflows tend to be smaller (675.0 million USD) than winner funds with high absolute net inflows (976.4 million USD).[16] Conditioning on manager changes yields a subgroup "without manager change" which has slightly higher inflows (last row of panel (a)) and a larger average fund size (last row of panel (d)) compared to the subgroup "with manager change".

[Please insert **Table II** about here]

Winner-decile-10 funds, on average, generate alphas of 0.01 percent per month, equivalent to a mean reversion from the formation to the evaluation period of -0.81 percentage points per month (Table III, panels (a) and (c), and Figure 3). Winner funds experiencing neither high inflows nor a manager change outperform the benchmark model (2) by an insignificant 0.08 percentage points per month. This corresponds to a significant mean reversion of -0.69 percentage points per month. Winner funds suffering from both high inflows and a manager change generate negative, albeit insignificant, alphas of -0.11 percent per month, equivalent to a significant mean reversion of -0.96 percentage points per month. The evaluation-period spread in alphas of 0.19 percentage points per month between winner funds experiencing neither

[15] This is higher than the industry average of 15 percent across the sample period (which includes funds in deciles 2-9 as well as those in deciles 1 and 10).

[16] According to Chen et al. (2004), differences in fund size affect fund performance. However, using relative net inflows instead of absolute net inflows yields more uniformly distributed subgroups with respect to fund size, but with very similar conclusions with respect to investment performance. Thus, our results do not seem to be affected by differences in fund size.

mechanism and those experiencing both is significant in statistical and economic terms (0.19 = 0.08 (low/ without) – (-0.11) (high/ with), Table III, panel (a)). The difference in raw returns between winner funds suffering from both equilibrating mechanisms and those affected by neither is also striking: raw returns of the former revert to equilibrium at a statistically significant -1.16 percentage points per month compared with -0.62 percentage points per month for the latter (Table IV, panel (c)). We conclude from this that fund flows and manager changes acting together strongly contribute to mean reversion in winner-fund performance.

[Please insert **Tables III** and **IV** and **Figure 3** about here]

As we have already seen in Table II, panel (b), the occurrence of a manager change seems to be independent of fund flows, since, on average, 17 percent of managers change each year in both subgroups with high and low net inflows. The difference in monthly fund flows between winner funds without and those with a manager change is statistically significant but economically small at 3.6 million USD. This suggests that the incidence of one mechanism does not affect the likelihood of the other mechanism occurring.

Even though the mechanisms appear to operate independently of each other, controlling for one could still alter the impact of the other on future performance, and this is what we find. Among winner funds, there is evidence that the two mechanisms interact as complements. If there is a manager change, high fund inflows have a significantly negative impact on performance of 0.22 percentage points per month, whereas if there is no manager change, the effect of high inflows is to reduce performance by only (albeit a still significant) 0.13 percentage points per month (Table III, panel (a)). Comparing the single sort results, fund flows have a powerful effect on performance with the spread in alphas between the low-inflow and high-

inflow groups being a significant 0.15 percentage points per month. In contrast, a single sort on manager change has little effect on the performance of these winner funds with only a 0.01 percentage points per month spread.

We conclude that fund flows by themselves and, especially if reinforced by a manager change, significantly affect winner-fund performance and that fund flows and manager changes are complementary to each other. However, high net inflows are much more harmful for subsequent performance than a manager change, possibly as a result of the transaction costs triggered by a liquidity-induced increase in trading. A manager change by itself has little effect.

5.2. LOSER FUNDS

Loser funds, on average, are smaller than winner funds with total net assets of 700.4 million USD in the formation period (Table V, panel (d)). Fund size decreases only slightly to an average of 681.0 million USD in the evaluation period. This is explained by negative net inflows, as expected, although these are relatively small in magnitude at only -2.3 million USD per month, on average. The explanation is that many investors are reluctant to withdraw money from poorly performing funds. We sort the loser-decile-1 funds into two subgroups on the basis of net inflows, one experiencing the lowest net inflows (i.e., the largest outflows) averaging -12.4 million USD and the other with high net inflows averaging 7.8 million USD. The difference in average fund flows between the low- and high-fund-flow subgroups of loser funds is only about two-thirds as large as the same difference for winner funds (20.2 versus 28.2 million USD). Loser funds with high net inflows and a manager change are the smallest subgroup in the formation period with an average size of 374.1 million USD, while loser funds experiencing both governance mechanisms simultaneously are the largest at 688.6 million USD (Table V, panel (c)).

[Please insert **Table V** about here]

Tables VI and VII report the interactions of the two governance mechanisms and fund performance. Loser-fund performance, on average, reverts from alphas of -0.89 percent per month in the formation period to (a still significantly negative) -0.21 percent per month in the evaluation period, a statistically significant performance improvement of 0.68 percentage points per month (Table VI, and Figure 4). However, distinct differences emerge in evaluation-period performance when conditioning on the mechanisms. Loser funds that benefit from both mechanisms have insignificant alphas of -0.09 percent per month in the evaluation period compared with significant alphas of -0.90 percent per month in the formation period which corresponds to a significant and striking mean reversion of 0.81 percentage points per month. Funds without either form of mechanism continue to significantly underperform by -0.25 percentage points per month, regressing to the mean by just 0.63 percentage points per month. The spread in alphas between loser funds experiencing both mechanisms and those benefiting from neither is a highly significant 0.16 percentage points per month (0.16 = -0.09 (low/ with) – (-0.25) (high/without), Table VI, panel (a)). Differences in mean reversion based on raw returns are even more pronounced: the raw returns of loser funds with a manager change and low net inflows improve by a (weakly) significant 0.84 percentage points per month; while the raw returns of loser funds without a manager change and high net inflows improve by an insignificant 0.56 percentage points per month (Table VII, panel (c)). Thus, if operating simultaneously, the internal and external governance mechanisms strongly contribute to an improvement in loser-fund performance.

[Please insert **Tables VI** and **VII** and **Figure 4** about here]

How do the mechanisms contribute to this effect? A comparison of the two subgroups reveals that they interact positively: funds with low net inflows have a higher fraction of manager changes (22 percent) than funds with high net inflows (16 percent),[17] and funds with a manager change have lower net inflows (-4.5 million USD per month) than funds without (-1.8 million USD per month) (Table V, panels (a) and (b)). Moreover, internal and external governance among loser funds are also complements in terms of their performance impact. The alpha spread between loser funds with low net inflows and those with high net inflows is significantly positive at 0.19 percentage points per month only when internal governance is operating at the same time. If there is no internal governance, this spread is a weakly significant 0.08 percentage points per month (Table VI, panel (a)). Conversely, the spread between loser funds with a manager replacement and those without is positive but insignificant at 0.08 percentage points per month if money is flowing out of the fund at the same time, while it is negative and also insignificant at -0.03 percentage points per month if outflows do not occur. Thus, internal governance seems to be more effective if external governance is simultaneously operating.

The results for raw returns are similar in magnitude. Outflows improve loser-fund raw returns by a significant 0.21 percentage points per month in combination with a manager replacement, and a positive but insignificant 0.08 percentage points per month in the case of no manager change (Table VII, panel (a)). Compared with the similar sized alpha spread of the same subgroup, this implies that fund managers who stay with the fund do not seem to use the outflows to re-optimize their portfolio by bringing in new investment ideas, but merely scale

[17] This compares with a 15 percent average turnover of managers across the industry and a 17 percent average turnover for winner fund managers, suggesting that high net inflows can protect even a poorly performing fund manager from being fired in some circumstances.

down existing investments in a way that reduces unfavorable factor loadings in the benchmark model. Specifically, loser funds without outflows have significantly negative momentum loadings, while those experiencing outflows reduce these loadings to levels close to zero (not reported in the tables).

We conclude that loser funds suffer from two types of disposition effect: one due to investor behavior and one due to the actions of the fund management company. It appears that a large fraction of loser-fund investors are reluctant to withdraw their money. This behavior is consistent with a disposition effect, whereby investors are hesitant to realize losses and so stay invested in the hope that the fund price eventually returns to the original purchase price. However, our results also show that staying invested in loser funds is a sub-optimal strategy, because performance remains negative. The second disposition effect relates to the reluctance of the fund management company to fire the underperforming manager. Even when outflows occur, as in case of the low net inflow subgroups, the performance of existing fund managers does not respond positively to the smaller asset base. It is only when a manager change is combined with outflows that performance significantly improves. However, outflows by themselves have a significant effect in improving performance, although this is enhanced if the manager is also changed.

5.3. WINNER-LOSER SPREAD

The spread in alphas between winner and loser funds for the 12-month portfolio formation period is 1.71 percentage points per month, obtained as the difference between the unconditional alphas in panel (b) of Table III (0.82 percent per month) and Table VI (-0.89 percent per month). The spread in alphas between the winner and the loser funds for the 12-month evaluation period is 0.22 percentage points per month, obtained as the difference between the

unconditional alphas in panel (a) of Table III (0.01 percent per month) and Table VI (-0.21 percent per month). This spread is similar to the winner-minus-loser spread in the Carhart (1997) study, although his spread is statistically significant.

A key issue now is how this spread is affected by the equilibrating mechanisms. Specifically, we compare the performance of the winner and loser portfolios in seven different scenarios, which are defined in panel (a) of Table VIII. Panel (b) reports the corresponding alphas (see also Figure 5). In the first column of panel (b), we report the alphas of funds that experience neither mechanism. Our hypotheses suggest that we would expect to find the highest level of positive and negative performance persistence among these funds. The next two columns report the performance results when either the fund-flow or the manager-change mechanism is not operating. The fourth column reports the unconditional winner-minus-loser spread, not taking fund flows or manager changes into account. The next two columns report the results for funds that experience one of the mechanisms. In the last column, the results where both mechanisms operate simultaneously are reported. In this last case, we would expect to find the strongest tendency of fund performance to revert to the mean.

[Please insert **Table VIII** and **Figure 5** about here]

We find that winner and loser funds that experience neither mechanism yield a highly significant winner-minus-loser spread of 0.34 percentage points per month (Table VIII, panel (b), column (1), and Figure 5). The spread does not change for funds not experiencing high inflows (column (2)). The spread falls to an insignificant 0.25 percentage points per month when conditioning on funds not experiencing a manager change (column (3)). For the unconditional winner-minus-loser spread portfolio, alphas turn out to be an insignificant 0.22 percentage

points per month as noted above (column (4)). This spread decreases further – when concentrating only on funds that experience either the manager-change mechanism or the fund-flow mechanism – to an insignificant 0.20 and 0.09 percentage points per month, respectively (columns (5) and (6)). For winner and loser funds that experience both equilibrating mechanisms simultaneously, we find an insignificant spread between winner and loser funds of -0.02 percentage points per month (column (7)). Thus, when investors and managers take advantage of outperformance or investors and the fund management company react to underperformance in the formation period, the equilibrating processes force the spread between previous winner and loser funds to become virtually zero (-0.02 percentage points per month) in the evaluation period. In contrast, if funds are not exposed to these mechanisms, the spread is a significant 0.34 percentage points per month. The equilibrating mechanisms seem to be able to explain the reduction in the winner-minus-loser spread by 0.36 percentage points per month.

This highlights the importance of fund flows and manager changes in explaining mean reversion in mutual fund performance and why mutual fund performance is unlikely to persist in well-functioning markets. The table also reconfirms both the dominance of fund flows (cf. the difference between columns (5) and (6)) and the strong supporting role of manager changes when the fund-flow mechanism is also operating (cf. the difference between columns (6) and (7)).

6. Robustness tests

In this section, we document that these results are robust to a number of different tests.

6.1. THE EFFECT OF DIFFERENT FACTOR MODELS

We applied alternative five-factor models to investigate whether the results differed from those using the standard four-factor model in (2). In the first model, we included a mean reversion

factor (based on six value-weighted portfolios formed on the size and prior returns of all NYSE, AMEX and NASDAQ stocks[18]) to the standard model: if winner funds hold on to winner stocks for another one or two years, these winner stocks might eventually experience mean reversion in returns (De Bondt and Thaler, 1985, 1987). In the second model, we included a liquidity-factor[19] to the standard model on the grounds that fund flows may also affect portfolio liquidity. We do not present the results using these models, but can confirm that they are qualitatively similar to those using (2).

6.2. THE EFFECT OF INTRODUCING PEER-GROUP BENCHMARKS

We adjusted for peer-group benchmarks, since these are widely used by practitioners for evaluation purposes. We used two alternative approaches.

In the first approach, we define the peer-group-adjusted returns as the difference between the fund's returns and the average returns of all peer-group funds with the same fund style. We classified the funds in our sample into 13 styles: large-cap, mid-cap, small-cap, growth, growth & income (G&I), income, sector funds (financial, health, natural resources, technology, utilities, other), and other. The results from evaluating performance from a ranking based on these peer-adjusted benchmark returns are presented in Table IX for both winner and loser subgroups. Compared with the results for raw returns, the low-minus-high row is generally lower and the without-minus-with column is generally higher, but otherwise of similar order of magnitude (cf Table IX with panel (a) of Tables IV and VII). The only exception is for the returns of winner funds with a manager change but low net inflows which are significantly lower: the corresponding low-minus-high spread is no longer significant for this subgroup. The fact that

[18] Downloaded from Kenneth French's website: mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[19] Downloaded from Lubos Pastor's website: faculty.chicagobooth.edu/lubos.pastor/research

the low-minus-high row is generally lower suggests that investors also respond to peer-group differences in the performance of fund managers (in addition to differences in alphas) and this contributes to the effectiveness of the fund-flow mechanism.

[Please insert **Table IX** about here]

The second approach that we adopted was to estimate the model recently suggested by Hunter et al. (2014) which adds an active peer benchmark (APB) to the four-factor model to control for the fact that estimation errors are potentially not independently distributed in the cross section of funds. Adding an APB can help to account for dynamically changing "commonalities" across fund returns (as a result of the funds following similar investment strategies) and to improve the estimation of the prior covariance matrix (see also Pastor and Stambaugh, 2002). Hunter et al. (2014) show that the APB can explain a significant proportion of the cross correlation between the residuals in the four-factor model for the different funds. In particular, they show that the within-group (individual fund pair) residual correlations are decreased by one-third to one-half of their prior levels, depending on the peer group. This indicates that the APB successfully captures common idiosyncratic risk-taking within peer groups. The APB for each peer-group was estimated as the residual series from a regression of an equal-weighted portfolio of all funds with the same investment style on the standard four factors in Equation (2). We used the same 13 investment styles as for the peer-group-adjusted returns listed above.

Table X reports the performance evaluation results from ranking funds on the basis of this APB adjustment, and these results can be compared with the performance results from the standard benchmark model in Tables III and VI. The results are robust to the addition of the

APB for ranking on past performance. For winner funds, the alphas in panel (a) of Table X are in general similar to those in panel (a) of Table III. There is again one exception: winner funds with a manager change but low net inflows now significantly outperform the extended benchmark model (2) by 0.23 percentage points per month (without the APB adjustment, the outperformance was an insignificant 0.11 percentage points per month). The results for loser funds are quantitatively very similar, comparing panel (b) of Table X with panel (a) of Table VI.

Overall, the addition of various peer-group benchmarks does not change the qualitative findings from the standard four-factor model.

[Please insert **Table X** about here]

6.3. A ROBUSTNESS TEST OF THE EMPIRICAL BAYES APPROACH

In an unreported test, we addressed a concern that, in our empirical Bayes approach, the prior and conditioning information are potentially not independent because the prior is the cross-sectional mean (θ_i) of all the funds in the sample which includes the fund *i* under consideration. This could potentially bias our results if fund *i* is an outlier. We therefore re-estimated the model using the cross-sectional median rather than the mean as the prior to reduce the effect of any outliers. However, this did not significantly affect our results: monthly alphas only change by 1-2 basis points and, in a very few cases, by 3 basis points.

6.4. TESTING A COROLLARY TO OUR KEY HYPOTHESIS

The key hypothesis in this paper is that if one or both of the equilibrating mechanisms are operating, then performance will not persist: there will be mean reversion which will be measured by the decline in alpha between the formation and evaluation periods. A corollary is that if performance does persist and neither mechanism is operating effectively, then other characteristics of the funds and the market in which those funds operate must explain the

persistence. To assess this, we formed sub-samples of funds that are matched on the basis of six key characteristics for which data are available: fund size, fund age, investment style, size of distribution fees, fund family size, and investor type.

6.4.1 Winner Funds

We begin with Table XI which looks at the effect of these characteristics on the performance persistence of winner funds. Consistent with the evidence in Table III, panel (g) of Table XI shows that, across the full sample, the decline in alpha between the formation and evaluation periods ($\Delta\ \alpha_t$) averages -0.81 percentage points per month. However, the full sample includes around 600 sector-specific funds and funds with other investment styles whose behavior is unrepresentative of our overall results. When these funds are excluded, the decline in alpha between the formation and evaluation periods averages -0.76 percentage points (last row of panel (c)). Looking down the $\Delta\ \alpha_t$ column, winner funds appear to revert to the mean between the formation and evaluation periods by, in general, between -0.70 and -0.93 percentage points. We argue that the lower end of this range, between -0.70 and -0.75 percentage points, measures what might be called the level of "natural mean reversion". This is the mean reversion that takes place independently of the operation of the equilibrium mechanisms as a consequence of the luck of fund managers running out – most fund managers find themselves in the top decile of performance due to good luck.[20] Natural mean reversion might not, however, completely eliminate performance persistence. If there is any additional mean reversion, we put this down to the operation of the equilibrating mechanisms. If, on the other hand, the mean reversion is less,[21] then we can conclude that neither natural mean reversion nor the two mechanisms are

[20] See Blake et al. (2014; 2017, forthcoming).
[21] The change in alpha is lower in absolute terms.

working effectively and, as a consequence, performance will persist – at least over the 12 month horizon. We examine the six characteristics in turn.

(1) *Fund size*.[22] Panel (a) shows that $\Delta\alpha_t$ lies in the zone of natural mean reversion for both large and small funds. The last three columns indicate that the two mechanisms have no statistically significant effect, although the manager change mechanism has a little more power in economic terms in small funds than large funds, especially when combined with fund flows.

(2) *Fund age*.[23] Panel (b) shows that $\Delta\alpha_t$ lies in the natural mean reversion zone for old funds, but it is larger in absolute terms for young funds. The last three columns reveal that the fund-flow mechanism is highly effective in young funds, especially when combined with a manager change. Funds flows also have some effect (albeit a statistically weaker one) in old funds.

(3) *Investment style*. Most funds in the sample are either size or growth-versus-income oriented. The final row of panel (c) indicates that, when sector-specific funds and funds with other investment styles are excluded, $\Delta\alpha_t$ lies just inside the range where the equilibrating mechanisms begin to become effective; the last three columns show that both mechanisms are indeed working well, especially in combination.

Turning to the individual investment styles, we can see that both mechanisms are highly successful in removing the persistence in small-cap funds – which is a very intuitive finding, since such funds will have difficulties in managing flows for liquidity reasons. But the mechanisms do not work in growth funds, since $\Delta\alpha_t$ = -0.70 is already in the natural mean reversion zone. The mechanisms are less effective in large- and mid-cap funds, despite having a

[22] Large (small) funds are those with above (below) median size. Chen et al. (2004) and Cremers and Petajisto (2009) find a negative effect of fund size on performance.

[23] Old (young) funds are those with above (below) median age. Huij and Verbeek (2007) and Karoui and Meier (2009) report outperformance by young funds.

very large (in absolute terms) $\Delta\alpha_t$ of -0.93. This is also an intuitive result, since it is difficult for fund managers trading in S&P500 stocks with deep and liquid markets to identify systematically mispriced securities. Winner fund managers focusing on these investment styles are more likely to be winners because of luck. The table shows that their luck disappears without any additional support from the two mechanisms.

G&I and income funds are an outlier, with a $\Delta\alpha_t$ of just -0.36 after 12 months, suggesting that mean reversion has not been completely achieved within this time frame. We examined this sub-sample in further detail and looked at 24- and 36-month formation and evaluation periods. We found that the equilibrating mechanisms – particularly, the fund-flow mechanism – take longer to work (between two and three years).[24]

(4) *Size of the distribution fee*.[25] This affects the strength of a fund's distribution network. Panel (d) shows that the results are similar whether the distribution fee is high or low. In both cases, the size of $\Delta\alpha_t$ suggests that at least one of the mechanisms will be effective, and the last three columns confirm that it is the fund-flow effect.

(5) *Fund family size*.[26] The size of $\Delta\alpha_t$ in panel (e) suggests that at least one of the mechanisms is effective whether the fund family is large or small. The fund-flow mechanism is particularly effective in small fund families, especially in conjunction with a manager change. It is reasonable to conjecture that large fund families are more able to handle strong inflows and

[24] Carhart (1997, Figure 2) showed that the top and bottom decile funds can take up to four years for the persistence to be eliminated in his 1962-1993 data set.

[25] High (low) distribution fees are those above (below) the median distribution fee. Distribution fees comprise the front-end load (as the majority of this is usually paid to a distribution partner) plus 12B-1 fees (annual marketing fees, generally between 0.25 and 1.00% (the maximum allowed) of a fund's net assets, named after a section of the Investment Company Act of 1940). Carhart (1997) documents a negative effect from fees on net performance.

[26] Large (small) fund families are those with above (below) median size.

situations where the manager is leaving than small fund families. So the equilibrating mechanisms should be weaker for larger fund families, which is what we find.

(6) *Investor type*. Panel (f) shows that with institutional funds, the size of $\Delta\alpha_t$ indicates that natural mean reversion will remove any persistence without the need for the equilibrating mechanisms. In the case of retail funds, fund flows, especially if reinforced by a manager change make a significant contribution to mean reversion. This confirms the well-known finding that retail investors react more strongly (and more irrationally) to good past performance than institutional investors (Del Gurcio and Tkac, 2002).

[Please insert **Table XI** about here]

6.4.2 Loser Funds

We now turn to Table XII which examines the effects of the same characteristics on the performance persistence of loser funds. If we again exclude the unrepresentative sector-specific and other investment-style funds, the increase in alpha between the formation and evaluation period averages 0.64 percentage points per month (last row of panel (c)). The $\Delta\alpha_t$ column shows that loser funds appear to revert to the mean between the formation and evaluation periods by, in general, between 0.59 and 0.75 percentage points, which is lower both in absolute terms and in range than is the case with winner funds. We will again argue that the lower end of this range, say, between 0.59 and 0.63 percentage points, measures the level of natural mean reversion for loser funds – reflecting the fact that many loser fund managers find themselves in the bottom performance decile due to bad luck. It follows that any additional mean reversion is due to the operation of the equilibrating mechanisms, while a lower degree of mean reversion implies that the mechanisms are not working over the 12 month horizon. We again examine the six characteristics in turn.

(1) *Fund size*. Panel (a) shows that, for large funds, $\Delta\alpha_t$ = 0.63 which is within the zone where natural mean reversion operates. This is confirmed by the last three columns which show that the two mechanisms are not working. However, for small funds, $\Delta\alpha_t$ at 0.75 is much higher and this is explained by investors taking money out of these funds.

(2) *Fund age*. Panel (b) reveals that both mechanisms are highly effective in removing persistence in old funds, but are completely ineffective in the case of young funds, despite the fact that $\Delta\alpha_t$ is similar for both types of funds. It is also interesting to note that it is only in the case of old funds that the manager-change mechanism is effective by itself (see the single sorting with-minus-without column). This appears to suggest that investors are prepared to give the managers of new loser funds a chance to rectify their poor performance, but not those in established funds.

(3) *Investment style*. The final row of panel (c) shows that the fund-flow mechanism is effective on average across all investment styles.[27] Digging down more deeply, we observe that this mechanism is particularly effective with small-cap funds, and also with growth, large- and mid-cap funds if accompanied by a manager change. However, as with the case of winner funds, the mechanisms do not work in G&I and income funds over a one-year horizon (the $\Delta\alpha_t$ is only 0.44). Looking at 24- and 36-month formation and evaluation periods for these investment styles, we find that there is still some residual persistence even after three years, despite the fact that the manager-change mechanism has some effect over the 24 month horizon. A possible explanation for funds with G&I and income investment styles being outliers for both winner and loser portfolios is an investor clientele effect. These funds are primarily held by investors interested in their long-term income-generating capabilities and are eschewed by other types of

[27] Panel (g) shows that this holds whether or not sector and other funds are included.

investor, e.g., those more interested in growth than income. Income-seeking investors will be prepared to hold on to loser funds, while growth-seeking investors will not rush into winner funds, preferring instead to look for more attractive opportunities in other sectors.

(4) *Size of the distribution fee*. Panel (d) shows that in terms of distribution fees, despite having virtually the same $\Delta\alpha_t$, there is a powerful fund-flow effect in the case of funds with low distribution fees, but not in the case of funds with high distribution fees. The latter appear to be able to restrict outflows using a strong distribution network, thereby hindering the equilibrating mechanism.

(5) *Fund family size*. In contrast with the case for winner funds, fund flows are more effective in restoring equilibrium in the loser funds of large fund families than those of small families, especially when combined with a manager change (panel (e)).[28] Further, the internal governance mechanism is very weak, particularly in the case of small families: the latter might be owner-managed and the owner is unlikely to sack herself.

(6) *Investor type*. Panel (f) shows that the results are similar to the case of winner funds. Natural mean reversion removes the persistence in institutional funds without the need for the equilibrating mechanisms. In the case of retail funds, fund outflows, especially if reinforced by a manager change, make a significant contribution to mean reversion, although it is weaker than in the case of winner funds. This is perhaps a little surprising, given the well documented evidence that retail customers are prone to a disposition effect.

[Please insert **Table XII** about here]

[28] This finding supports the predictions of Gervais et al. (2005) that a manager replacement in a large family contains more information, particularly if it is associated with an underperforming manager.

6.4.3 Comment

The robustness tests in this section provide broad support for the key hypothesis of this paper: performance persists unless either the two equilibrating mechanisms or natural mean reversion operate to remove it. However, this needs to be qualified as follows. The mechanisms do not appear to work for loser G&I and income funds over a one-year horizon: in the case of winner funds with these investment styles, for example, it takes two years rather than one for the persistence to be eliminated.

A further implication is that we do not find any other unobserved characteristic explaining the persistence spread. Our sorting procedure explains how we reach this conclusion. We re-form all portfolios every year based on the previous year's performance. So, over the course of the full sample, individual funds move between the sub-portfolios (e.g., from winner to loser, from low to high flow, from without to with manager change, and vice versa). If the portfolios were established once at the beginning of the sample period, then it might be possible that another unidentified characteristic could explain the performance spread we observe. But with the continuous re-forming of portfolios, each fund will move across many different sub-portfolios over the 20 years of our sample period. Hence, even if there is some unobserved characteristic, a fund with a specific embodiment of that characteristic would move between many different sub-portfolios over time and, thus, the characteristic is unlikely to play a significant role in explaining our findings.

6.5. CONTROLLING FOR DIFFERENT MARKET CONDITIONS

Glode et al. (2012) extend the Berk-Green framework to examine the issue of whether the way that investors respond to past performance through fund flows helps to identify predictability in mutual fund returns. They find that there is predictability in mutual fund returns and that it is also time-varying, with successful funds displaying persistent performance after periods of high

market returns, but not after periods of low market returns. They find no persistence in under-performing funds, irrespective of market conditions.

We adapt this analysis of time-varying persistence to examine the strength of the equilibrating mechanisms that we have identified, controlling for market conditions. Glode et al. (2012) identify up-markets and down-markets using excess market returns on a quarterly basis. Our data set does not allow us to conduct such a high-frequency analysis. Instead, we identify four sub-periods within the full sample from 1992 to 2011: 1992 to 2000 (bull market), 2001 to 2003 (bear market), 2004 to 2007 (bull market) and 2008 to 2011 (bear market). Within each sub-period, we calculate both the degree of persistence in mutual fund performance and the alpha spreads on the basis of single and double sorts by fund flows and manager changes.

The first column of panel (a) of Table XIII shows that there is little evidence of persistence (as measured by the evaluation period alpha) for the winner funds, irrespective of market conditions. The $\Delta\alpha_t$ column indicates wide variation in the decline in alpha across the four sub-periods and there is insufficient information to determine the level of natural mean reversion, although it too is likely to differ widely across the sub-periods. Nevertheless, in most sub-periods, the persistence is removed by the operation of the fund-flow mechanism, if only weakly during the 2001-2003 bear market (column 4).

There is, however, persistence for loser funds in both bear markets of 2001-2003 and 2008-2011, despite, in the latter case, fund flows operating much more effectively than in the earlier bear market (panel (b)). This confirms findings first made by Carhart (1997) that there is some persistence in the worst performing loser funds. Carhart did not separate his 1962-1993 data set into bull and bear sub-periods, but our findings would appear to suggest that any persistence in the worst performing loser funds will be concentrated in bear market sub-periods.

The only occasion in which manager changes had a statistically significant effect in eliminating persistence was in loser funds in the 1992-2000 bull market (column 6).

[Please insert **Table XIII** about here]

7. Conclusions and Implications

We have examined the effects of fund flows and manager changes as equilibrating mechanisms in explaining the removal of persistence in mutual fund performance over time. Using a CRSP sample of 6,207 actively managed U.S. equity mutual funds over the period from 1992 to 2011, we find that a significant part of the mean reversion in both winner and loser funds is explained by the two mechanisms operating together, i.e., by the responses of investors, fund managers and fund management companies to past performance.

We have found that winner funds with high inflows experience a deterioration in subsequent performance. This effect is much more important in explaining below-average performance than, say, the impact of fees. We therefore provide empirical support for the Berk and Green (2004) hypothesis that inflows of new money contribute significantly to mean reversion. We also found that winner funds with a manager change suffer from a deterioration in subsequent performance, but the effect is very small compared with the impact of fund flows. Further, winner funds where both mechanisms operating simultaneously experience an amplified effect on future performance, confirming that the mechanisms are complements.

With respect to loser funds, we found funds with high outflows enjoyed an improvement in subsequent performance. For loser funds with a manager change, we observe improved subsequent performance, but again the effect is very small compared with the impact of fund flows. Further, we found that loser funds experiencing both mechanisms benefit from an

amplified positive effect on future performance, again confirming that the two mechanisms are complements.

The positive performance spread between previous winner and loser funds is completely eliminated if both equilibrating mechanisms are operating simultaneously and almost entirely eliminated if just the fund-flow mechanism is working in the two sets of funds. We also confirm the corollary that, in the absence of the two mechanisms, there is persistence in fund performance with past winners continuing to outperform past losers. We can additionally confirm that any persistence in the worst performing loser funds will be concentrated in bear market sub-periods.

What are the potential implications of these findings? Investors should pay close attention to fund flows and the resulting changes in fund size as well as to the career paths of individual fund managers across different funds: our results suggest that superior past performance is only a reliable indicator of future performance for those cases where the manager remains in post and fund flows are not excessively responsive to past performance. An example of a potentially successful strategy would therefore be to invest in previous-year winner funds with low inflows and no manager change.[29] Of course, investors pursuing such a strategy will only speed up the equilibrium process and only first movers might have any prospect of benefiting. Following directly from this, it would be very valuable for investors and for the market equilibrium processes to work more efficiently if fund management companies were required to publish regular information on fund flows and report any manager changes immediately.

[29] Investors could potentially earn 0.08 percent per month abnormal returns (Table III, panel (a)).

Our robustness results indicate that the mechanisms are more effective in the following types of winner funds: small funds, young funds, small-cap funds, funds from small fund families, and retail funds. They are also more effective in the following types of loser funds: small funds, old funds, funds in most investor style categories, and retail funds. However, investors should be aware that growth & income and income funds are unusual in that mean reversion takes longer to establish in winner funds than is the case with funds with a different investment style (around two years instead of one); while in the case of loser funds, there remains some persistence even after three years. We put this finding down to an investor clientele effect: investors appear to be primarily interested in income generation and this dominates concerns about short-term capital value losses. Finally, if they are living through a bear market, investors can expect the poor performance of the worst performing loser funds to last for longer than in boom conditions.

Overall, our results are consistent with studies which show that, while true investment skill exists, investors usually cannot benefit from it (e.g., Berk and van Binsbergen, 2016; Blake et al., 2014; 2017, forthcoming).

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Appendix: Data Selection

In constructing our sample, we follow Pastor and Stambaugh (2002) and select only domestic equity funds. We exclude international funds, global funds, balanced funds, flexible funds, and funds of funds. We further drop all funds containing terms in their name that commonly refer to passive vehicles. We require our funds to have at least 12 months of return data available to be included in our sample. Additionally, we drop all observations prior to the IPO date given by CRSP and funds without names in order to account for a potential incubation bias (Evans, 2010). This results in 6,207 funds that existed at some time during our sample period from 1992 to 2011. Different share classes of the same fund have the same manager and fund flows of individual share classes cancel out at the portfolio level. Hence, we combine all share classes that belong to the same fund and have the same underlying portfolio to one observation. We use a matching algorithm that combines information from the fund's name and the portfolio number variable given by CRSP.[30] Fund characteristics, such as the investment objective or the first offer date, are taken from the oldest share class. Quantitative information is either summed up, such as total net assets, or the weighted average over all share classes are taken, such as returns and fees. If two share classes of the same funds have different manager change dates, we use the most recent date. We classify the funds in our sample into three groups: (1) large and mid-cap funds (LMC), (2) small-cap funds (SC), and (3) sector funds (SEC). Because ICDI classification codes are no longer available in the 2011 cut off of the CRSP mutual fund database, we modify the selection criteria of Pastor and Stambaugh (2002) as follows. For our classification, we use Lipper codes, Wiesenberger codes and Strategic Insight codes (priority is given in that order if different codes are not consistent). Details are given in Table XIV. A fund is assigned to one of

[30] A matching solely based on the portfolio number variable is not possible, as this variable is available only from December 1998 onwards.

the three groups for the total sample period if it belonged to this group for at least 50 percent of the observations in our sample period. We also classified our sample of domestic equity funds into the following 13 style groups: cap-based funds large-cap; cap-based funds mid-cap; cap-based funds small-cap; style funds growth; style funds growth and income; style funds income; sector funds financial; sector funds health; sector funds natural resources; sector funds technology; sector funds utilities; sector funds other; and other.

[Please insert **Table XIV** about here]

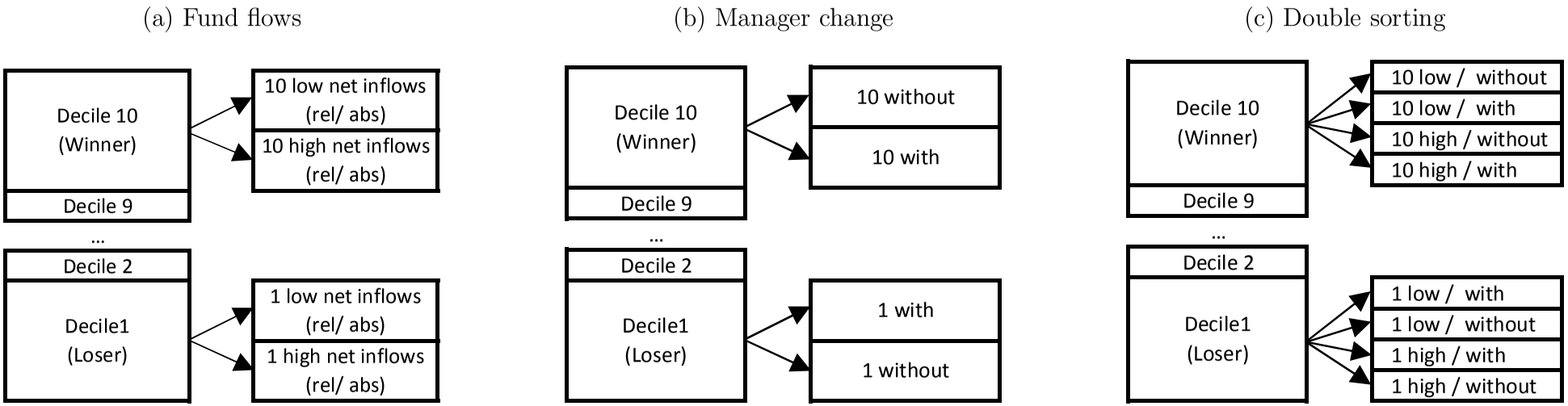

Figure 1: This figure presents the methodology we apply to construct the subgroup portfolios. Funds are first sorted into deciles based on their performance in the formation period. Then, the winner (decile 10) and loser (decile 1) funds are further divided into: (a) a low-net-inflow (high-net-inflow) subgroup if the net inflows in the formation period are lower (higher) than the median net inflows of the decile to which the funds belong (we experimented with both absolute net inflows and relative net inflows, but, in the presentation of our results, we concentrate on absolute flows); (b) a without (with) manager-change subgroup if the manager remained the same (changed) during the formation period; and (c) into four subgroups combining the criteria in (a) and (b) in a double sorting mechanism.

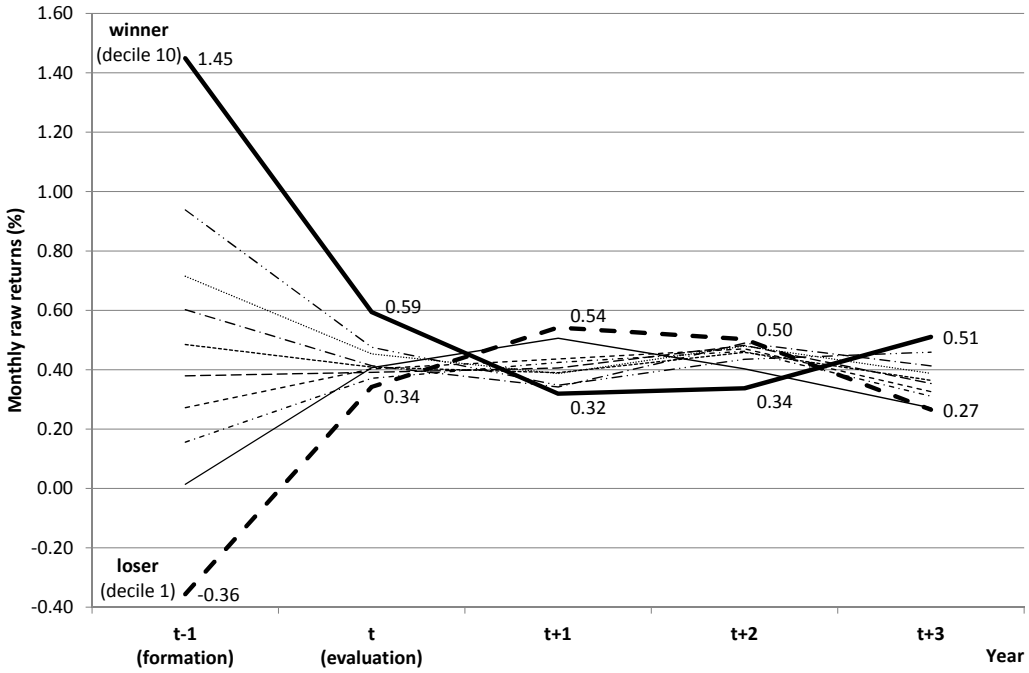

Figure 2: This figure presents the average monthly raw returns in percent per month of the decile portfolios relative to the evaluation year (t). Portfolios are formed based on previous-year Bayesian four-factor alphas.

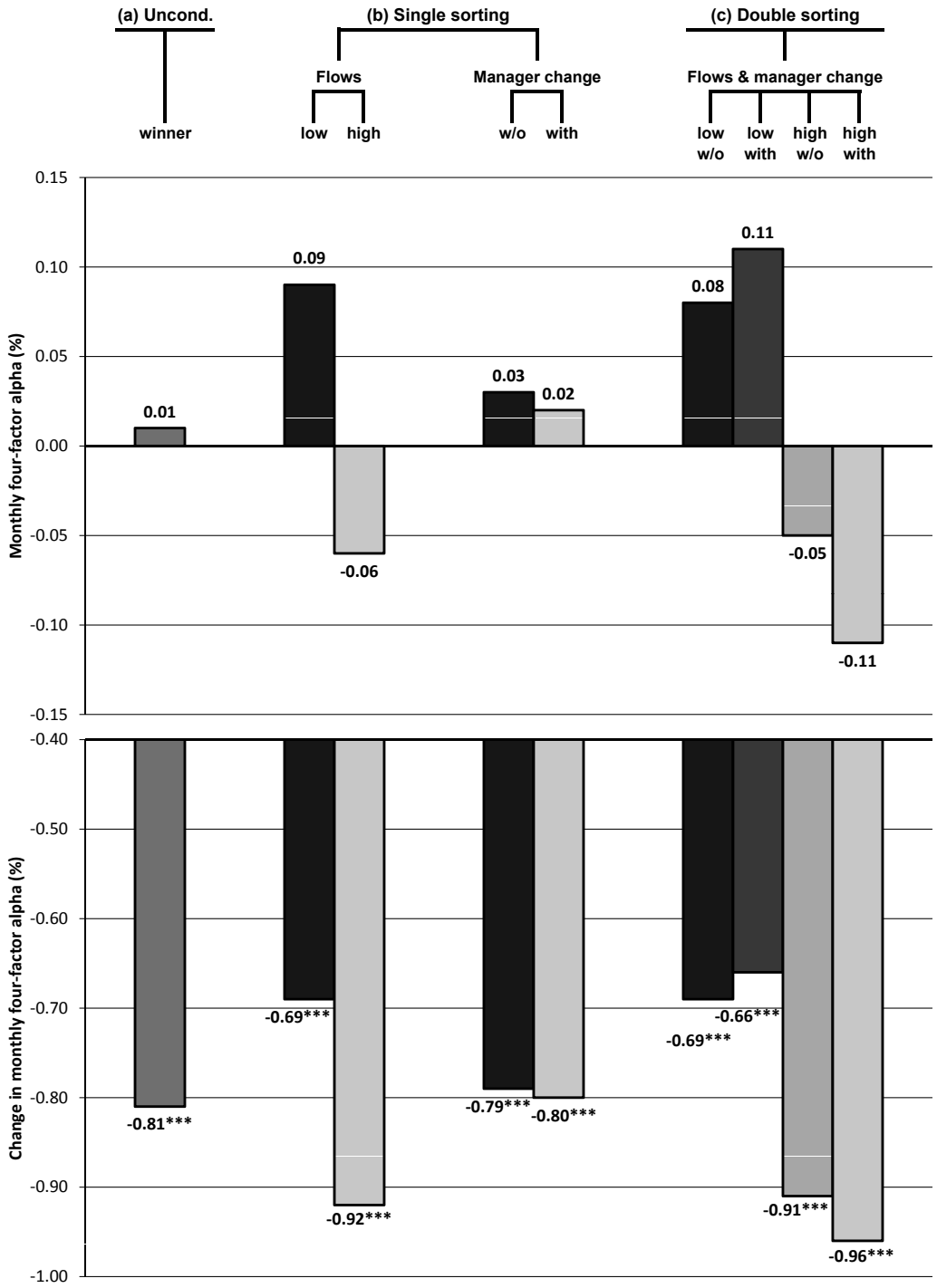

Figure 3: This figure presents monthly four-factor alphas in percent per month for winner funds and winner-fund subgroups based on both a single sorting and a double sorting on absolute fund flows and / or manager change. The top panel presents the level of performance (four-factor alpha) in the evaluation period and the bottom panel presents the change in performance between the formation and evaluation periods (Δ alpha). Funds are assigned to the high-net-inflow (high) or low-net-inflow (low) subgroup based on whether their net inflows during the formation period are higher or lower than the median net inflows of all other funds in the same decile. Funds are assigned to the manager-change (with) or no-manager-change (without) subgroup based on whether their fund manager changed during the formation period. Portfolios are formed based on previous-year Bayesian four-factor alphas. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

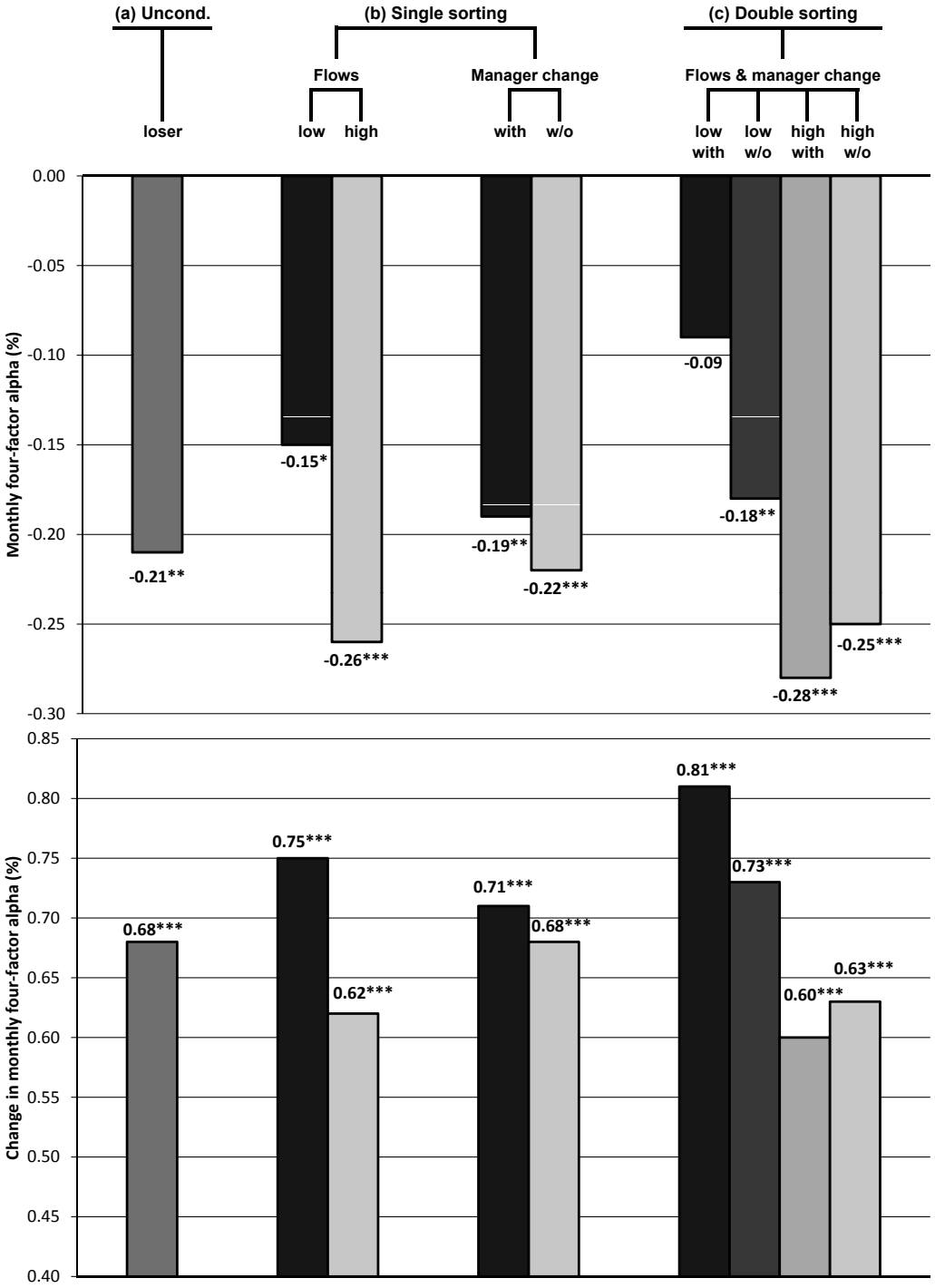

Figure 4: This figure presents monthly four-factor alphas in percent per month for loser funds and loser-fund subgroups based on both a single sorting and a double sorting on absolute fund flows and / or manager change. See the note to Figure 3 for more explanation.

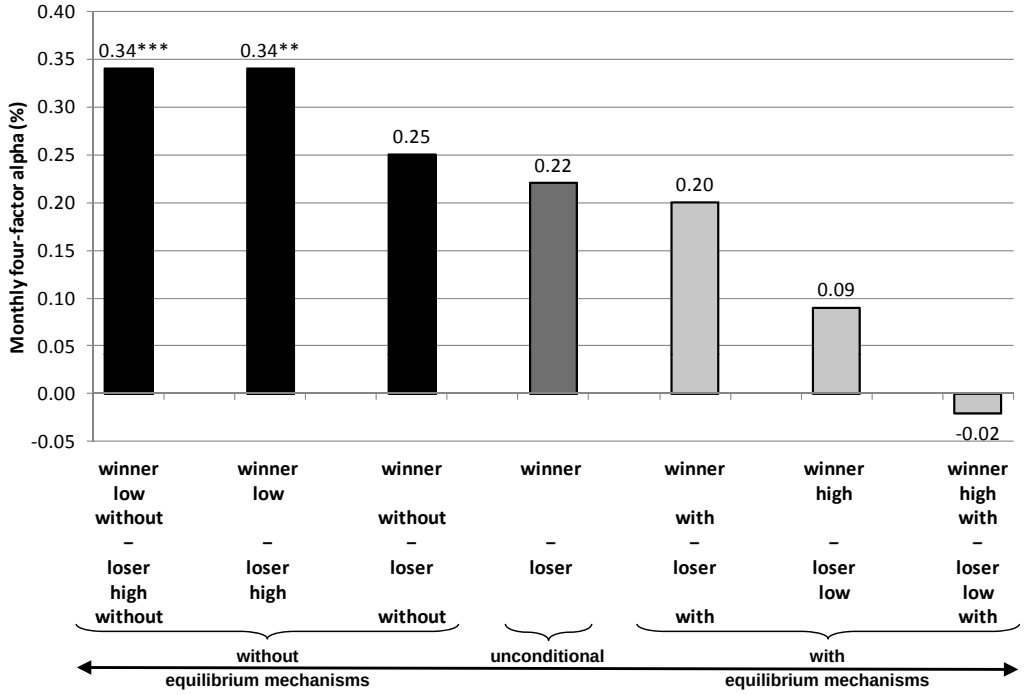

Figure 5: This figure presents monthly four-factor alphas in percentage points per month in the evaluation period for the winner-minus-loser spread portfolio based on both a single sorting and a double sorting on absolute fund flows and / or manager change. See the note to Figure 3 for more explanation.

Table I: Characteristics of the funds in the sample

This table presents the characteristics of the sample of funds for subperiods and for the whole period from 1992 to 2011. We restrict our sample to funds that have at least 12 months of available return data and information on the variable "mgr_date" in the CRSP database (see Appendix). Row (1) reports the number of months in the relevant period; row (2) reports monthly (arithmetic) average raw returns in excess of the rate on the risk-free asset in percent; row (3) reports the average portfolio turnover in percent; row (4) reports average fees in percent; row (5) reports the average age of the funds in years; row (6) reports the average fund size in million USD; row (7) reports monthly average absolute net inflows in million USD; row (8) reports the number of funds in existence; and row (9) reports the number of manager changes that occurred.

	Subperiods				Whole period
	1992–2000	2001–2003	2004–2007	2008–2011	
(1) # Months	108	36	48	48	240
(2) Raw returns (%)	0.82	-0.29	0.52	0.12	0.36
(3) Turnover (%)	105.17	136.15	95.64	92.42	104.42
(4) Annual fees (%)	1.45	1.51	1.39	1.36	1.42
(5) Fund age (years)	9.74	9.39	11.03	11.97	10.65
(6) Fund size (mill. USD)	753.68	754.38	1095.53	899.34	875.48
(7) Net inflows (mill. USD)	5.13	1.35	0.88	1.94	2.57
(8) # Funds	3,194	3,374	3,870	4,850	6,207
(9) # Man. ch.	3,173	1,517	1,799	1,430	7,919

Table II: Characteristics of winner funds and winner-fund subgroups

This table presents the characteristics of winner funds, winner-fund subgroups and the resulting spread portfolios based on independent sorts on absolute fund flows and manager change. See the note to Figure 1 for more explanation on the portfolio formation. Panel (a) reports average absolute net inflows in the formation period in million USD; panel (b) reports the fraction of funds experiencing a manager change during the formation period; panel (c) reports the average fund size in the evaluation period in million USD; and panel (d) reports the average fund size in the formation period in million USD. Within each panel, the first two rows and columns report values conditional on net inflows and manager change, respectively. The third row and column report spreads between the subgroups conditional on net inflows and manager changes, respectively. The fourth row and column report unconditional values, i. e., not conditioned on net inflows or manager changes, respectively. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Net inflows	Manager change			
	Without	With	Without − With	All
(a) Net inflows in formation period (flows_{t-1}, in million USD)				
Low	−5.0	−8.4	3.4***	−5.6
High	23.4	18.6	4.9***	22.6
Low − High	−28.4***	−27.0***	−23.6***	−28.2***
All	9.5	5.4	3.6***	8.5
(b) Manager changes in formation period (mgr_ch_{t-1}, in percentage points)				
Low	0	100	–	17
High	0	100	–	17
Low − High	–	–	–	–
All	0	100	–	17
(c) Fund size in evaluation period (TNA_t, in million USD)				
Low	657.6	1,016.1	−358.5***	715.8
High	1,542.1	936.2	605.9***	1,438.6
Low − High	−884.6***	79.9	−278.7***	−722.9
All	1,050.2	966.8	83.3*	1,037.0
(d) Fund size in formation period (TNA_{t-1}, in million USD)				
Low	622.7	947.0	−324.3***	675.0
High	1,055.8	590.0	465.9***	976.4
Low − High	−433.1***	357.1***	32.6	−301.4***
All	801.0	756.9	44.2	794.0

Table III: Alphas of winner funds and winner-fund subgroups

This table presents monthly four-factor alphas in percent of winner funds, winner-fund subgroups and the resulting spread portfolios (in percentage points) based on independent sorts on absolute fund flows and manager change. See the note to Figure 1 for more explanation on the portfolio formation and the note to Table II for more explanation on row and column definitions. Panel (a) reports average four-factor alphas in the evaluation period; panel (b) reports average four-factor alphas in the formation period; and panel (c) reports the change in four-factor alphas between the formation and evaluation periods. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

Net inflows	Manager change			
	Without	With	Without − With	All
(a) Four-factor alphas in evaluation period (α_t)				
Low	0.08	0.11	−0.03	0.09
High	−0.05	−0.11	0.06	−0.06
Low − High	0.13**	0.22**	0.19**	0.15***
All	0.03	0.02	0.01	0.01
(b) Four-factor alphas in formation period (α_{t-1})				
Low	0.77***	0.77***	0.00	0.77***
High	0.86***	0.86***	0.00	0.86***
Low − High	−0.09	−0.09	−0.08	−0.09
All	0.82***	0.82***	0.00	0.82***
(c) Change in four-factor alphas ($\Delta\alpha_t = \alpha_t - \alpha_{t-1}$)				
Low	−0.69***	−0.66***	–	−0.69***
High	−0.91***	−0.96***	–	−0.92***
Low − High	–	–	–	–
All	−0.79***	−0.80***	–	−0.81***

Table IV: Raw returns of winner funds and winner-fund subgroups

This table presents monthly raw returns in percent of winner funds, winner-fund subgroups and the resulting spread portfolios (in percentage points) based on independent sorts on absolute fund flows and manager change. See the note to Figure 1 for more explanation on the portfolio formation and the note to Table II for more explanation on row and column definitions. Panel (a) reports average raw returns in the evaluation period; panel (b) reports average raw returns in the formation period; and panel (c) reports the change in raw returns between the formation and evaluation periods. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Net inflows	Manager change			
	Without	With	Without − With	All
(a) Raw returns in evaluation period (r_t)				
Low	0.65	0.72	−0.07	0.66
High	0.54	0.50	0.03	0.53
Low − High	0.11*	0.21**	0.15	0.13**
All	0.60	0.62	−0.01	0.59
(b) Raw returns in formation period (r_{t-1})				
Low	1.27	1.23	0.04	1.26
High	1.63	1.66	−0.03	1.63
Low − High	−0.35	−0.43	−0.39	−0.37
All	1.46	1.43	0.03	1.45
(c) Change in raw returns ($\Delta r_t = r_t - r_{t-1}$)				
Low	−0.62	−0.51	–	−0.60
High	−1.09**	−1.16**	–	−1.10**
Low − High	–	–	–	–
All	−0.86*	−0.81	–	−0.85*

Table V: Characteristics of loser funds and loser-fund subgroups

This table presents the characteristics of loser funds, loser-fund subgroups and the resulting spread portfolios based on independent sorts on absolute fund flows and manager change. See the note to Table II for more explanation.

Net inflows	Manager change			
	With	Without	With − Without	All
(a) Net inflows in formation period ($flows_{t-1}$, in million USD)				
Low	−13.2	−12.2	−1.0	−12.4
High	6.9	7.9	−1.0	7.8
Low − High	−20.1***	−20.1***	−21.1***	−20.2***
All	−4.5	−1.8	−2.7***	−2.3
(b) Manager changes in formation period (mgr_ch_{t-1}, in percentage points)				
Low	100	0	–	22
High	100	0	–	16
Low − High	–	–	–	–
All	100	0	–	19
(c) Fund size in evaluation period (TNA_t, in million USD)				
Low	554.3	724.1	−169.8***	689.3
High	430.9	717.7	−286.8***	672.9
Low − High	123.4***	6.4	−163.4***	16.4
All	493.6	696.2	−202.7***	681.0
(d) Fund size in formation period (TNA_{t-1}, in million USD)				
Low	688.6	861.3	−172.8***	826.1
High	374.1	612.0	−238.0***	575.4
Low − High	314.5***	249.3***	76.5**	250.7***
All	547.2	712.1	−164.9***	700.4

Table VI: Alphas of loser funds and loser-fund subgroups

This table presents monthly four-factor alphas in percent of loser funds, loser-fund subgroups and the resulting spread portfolios (in percentage points) based on independent sorts on absolute fund flows and manager change. See the note to Table III for more explanation.

Net inflows	Manager change			
	With	Without	With − Without	All
(a) Four-factor alphas in evaluation period (α_t)				
Low	−0.09	−0.18**	0.08	−0.15*
High	−0.28***	−0.25***	−0.03	−0.26***
Low − High	0.19**	0.08*	0.16**	0.10**
All	−0.19**	−0.22***	0.03	−0.21**
(b) Four-factor alphas in formation period (α_{t-1})				
Low	−0.90***	−0.91***	0.00	−0.91***
High	−0.88***	−0.88***	0.01	−0.88***
Low − High	−0.03	−0.02	−0.02	−0.03
All	−0.89***	−0.90***	0.01	−0.89
(c) Change in four-factor alphas ($\Delta\alpha_t = \alpha_t - \alpha_{t-1}$)				
Low	0.81***	0.73***	–	0.75***
High	0.60***	0.63***	–	0.62***
Low − High	–	–	–	–
All	0.71***	0.68***	–	0.68***

Table VII: Raw returns of loser funds and loser-fund subgroups

This table presents monthly raw returns in percent of loser funds, loser-fund subgroups and the resulting spread portfolios (in percentage points) based on independent sorts on absolute fund flows and manager change. See the note to Table IV for more explanation.

Net inflows	Manager change			
	With	Without	With − Without	All
(a) Raw returns in evaluation period (r_t)				
Low	0.49	0.37	0.12**	0.40
High	0.28	0.29	−0.01	0.29
Low − High	0.21***	0.08	0.20***	0.11**
All	0.39	0.32	0.07*	0.34
(b) Raw returns in formation period (r_{t-1})				
Low	−0.35	−0.46	0.11	−0.44
High	−0.28	−0.27	−0.01	−0.27
Low − High	−0.07	−0.19	−0.08	−0.18
All	−0.33	−0.38	0.05	−0.36
(c) Change in raw returns ($\Delta r_t = r_t - r_{t-1}$)				
Low	0.84*	0.83*	–	0.84*
High	0.56	0.56	–	0.56
Low − High	–	–	–	–
All	0.71	0.69	–	0.70

Table VIII: Alphas of winner-minus-loser spread portfolios

This table presents monthly four-factor alphas in percent of the winner- and loser-fund subgroups and the resulting spread portfolios (in percentage points) based on independent sorts on absolute fund flows and manager change. Panel (a) reports details on the portfolio formation and panel (b) reports four-factor alphas. See the note to Figure 1 for more explanation on the portfolio formation. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

	Without equilibrium mech.			Uncond.	With equilibrium mech.		
	Neither	No flows	No manager change	–	Manager ch. only	Flows only	Both
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a) Portfolio formation							
Winner funds							
Inflows	Low	Low	–	–	–	High	High
Manager ch.	Without	–	Without	–	With	–	With
Loser funds							
Inflows	High	High	–	–	–	Low	Low
Manager ch.	Without	–	Without	–	With	–	With
(b) Four-factor alphas in evaluation period (α_t)							
Winner	0.08	0.09	0.03	0.01	0.02	−0.06	−0.11
Loser	-0.25^{***}	-0.26^{**}	-0.22^{***}	-0.21^{**}	-0.19^{**}	-0.15^{*}	−0.09
Winner − loser	0.34^{***}	0.34^{**}	0.25	0.22	0.20	0.09	−0.02

Table IX: Peer-group-adjusted returns of winner- and loser-fund subgroups

This table presents peer-group-adjusted returns in percent per month of winner and loser funds and the winner- and loser-fund subgroups as well as the resulting spread portfolios (in percentage points) based on independent sorts on absolute fund flows and manager change. Peer-group-adjusted returns are defined as the difference between fund i's returns and the average returns of all peer-group funds P with the same fund style. The following style groups exist in our data set (all U. S. domestic equities): cap-based funds large-cap; cap-based funds mid-cap; cap-based funds small-cap; style funds growth; style funds growth and income; style funds income; sector funds financial; sector funds health; sector funds natural resources; sector funds technology; sector funds utilities; sector funds other; and other. See the note to Figure 1 for more explanation on the portfolio formation and the note to Table II for more explanation on row and column definitions. Panel (a) reports the results for winner funds and panel (b) reports results for loser funds. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

(a) Winner funds: Peer-group adjusted returns ($r_{i,t} - r_{P,t}$)

Net inflows	Manager change			
	Without	With	Without − With	All
Low	0.16	0.09	0.06	0.14
High	0.06	0.06	−0.01	0.06
Low − High	0.10*	0.03	0.10*	0.09**
All	0.12	0.08	0.04	0.10

(b) Loser funds: Peer-group adjusted returns ($r_{i,t} - r_{P,t}$)

Net inflows	Manager change			
	With	Without	With − Without	All
Low	0.04	−0.11	0.15***	−0.07
High	−0.15	−0.14	−0.01	−0.15
Low − High	0.19***	0.03	0.18***	0.07**
All	−0.00	−0.13	0.08**	−0.11

Table X: Alphas of winner- and loser-fund subgroups based on a ranking including the active peer benchmark (APB) factor

This table presents monthly four-factor alphas in percent in the evaluation period of winner and loser funds and the winner- and loser-fund subgroups as well as the resulting spread portfolios (in percentage points) based on independent sorts on absolute fund flows and manager change. For ranking funds into decile portfolios, the four-factor model (Carhart, 1997) has been augmented by an active peer benchmark (APB) factor in order to control for the fact that estimation errors are potentially not independently distributed in the cross section of funds, as suggested by Hunter et al. (2014). See the note to Figure 1 for more explanation on the portfolio formation and the note to Tables II and V for more explanation on row and column definitions. Panel (a) reports the results for winner funds and winner-fund subgroups and panel (b) reports the results for loser funds and loser-fund subgroups. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

(a) Winner funds: Four-factor alphas in evaluation period (α_t)

Net inflows	Manager change			
	Without	With	Without − With	All
Low	0.13	0.23*	−0.10	0.14
High	−0.04	−0.06	0.01	−0.05
Low − High	0.17**	0.28**	0.18*	0.19**
All	0.05	0.09	−0.04	0.05

(b) Loser funds: Four-factor alphas in evaluation period (α_t)

Net inflows	Manager change			
	With	Without	With − Without	All
Low	−0.07	−0.16*	0.09	−0.14
High	−0.29***	−0.24***	−0.05	−0.25***
Low − High	0.22**	0.08*	0.17***	0.11***
All	−0.17**	−0.21**	0.04	−0.20**

Table XI: Alphas of characteristics-matched sub-samples of winner-fund subgroups

This table presents monthly four-factor alphas of spread portfolios of the characteristics-matched sub-samples of winner-fund subgroups (in percentage points) based on independent sorts on absolute fund flows and manager change. See the note to Figure 1 for more explanation on the portfolio formation. The first column reports the number of funds in the respective characteristics-matched sub-sample. Note that the number of observations of the sub-samples adds up to more than the total number of funds in our sample (6,207) because some funds appear in different sub-samples over their lifetime. The second column reports the change in four-factor alphas between the formation and evaluation periods. The third and fourth columns report spreads between the subgroups conditional on net inflows and manager changes, respectively. The fifth column reports spreads between the subgroups conditional on net inflows and manager changes simultaneously. Panel (a) reports the results for large (i. e., above median fund TNA) vs. small funds; panel (b) reports the results for old (i. e., fund age above median) vs. young funds; panel (c) reports the results for funds with different investment styles; panel (d) reports the results for funds with high (i. e., above median) vs. low distribution fees; panel (e) reports the results for large (i. e., above median fund family TNA) vs. small fund families; panel (f) reports the results for retail vs. institutional funds; and panel (g) reports the results for the full sample for comparison. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

		Persistence	Single sorting		Double sort.
	Number of obs.	$\Delta\alpha_t$	Low − High	Without − With	Low w/o − High with
(a) Fund size					
Large funds	3,466	−0.75***	0.06	−0.02	0.02
Small funds	5,371	−0.72***	0.06	0.11	0.15
(b) Fund age					
Old funds	3,858	−0.73***	0.10*	−0.03	0.04
Young funds	5,221	−0.83***	0.19***	0.06	0.35***
(c) Investment style					
Large- and mid-cap	579	−0.93***	0.07	0.21	0.23
Small-cap	898	−0.86***	0.20**	0.37***	0.43***
Growth & Inc. and Inc.	1,357	−0.36***	0.06	0.01	0.08
Growth	2,384	−0.70***	0.02	0.04	0.10
All exc. sector and other	5,619	−0.76***	0.07*	0.09*	0.14*
(d) Size of distribution fees					
High distribution fee	3,853	−0.79***	0.19***	−0.06	0.20**
Low distribution fee	2,994	−0.81***	0.18***	0.02	0.17
(e) Size of fund family					
Large fund families	4,055	−0.86***	0.11*	−0.04	0.04
Small fund families	3,337	−0.78***	0.15**	0.03	0.19**
(f) Investor type					
Retail	4,037	−0.81***	0.20***	−0.02	0.17*
Institutional	2,771	−0.71***	−0.02	0.11	0.19
(g) Full sample (for comparison)					
All	6,207	−0.81***	0.15***	0.01	0.19**

Table XII: Alphas of characteristics-matched sub-samples of loser-fund subgroups

This table presents monthly four-factor alphas of spread portfolios of the characteristics-matched sub-samples of loser-fund subgroups (in percentage points) based on independent sorts on absolute fund flows and manager change. See the note to Figure 1 for more explanation on the portfolio formation and the note to Table XI for more explanation on column and row definitions. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

		Persistence	Single sorting		Double sort.
	Number of obs.	$\Delta\alpha_t$	Low − High	Without − With	Low w/o − High with
(a) Fund size					
Large funds	3,466	0.63***	0.09	0.04	0.13
Small funds	5,371	0.75***	0.17***	0.08	0.17*
(b) Fund age					
Old funds	3,858	0.68***	0.18***	0.14**	0.27***
Young funds	5,221	0.66***	0.08	−0.09	0.01
(c) Investment style					
Large- and mid-cap	579	0.59***	0.01	0.15	0.26**
Small-cap	898	0.70***	0.14**	0.01	0.19
Growth & Inc. and Inc.	1,357	0.44***	−0.03	−0.00	0.01
Growth	2,384	0.62***	0.13**	0.06	0.17*
All exc. sector and other	5,619	0.64***	0.06*	0.05	0.17***
(d) Size of distribution fees					
High distribution fee	3,853	0.68***	0.03	0.08	0.12
Low distribution fee	2,994	0.69***	0.13***	0.04	0.21**
(e) Size of fund family					
Large fund families	4,055	0.70***	0.16**	0.07	0.19*
Small fund families	3,337	0.66***	0.10**	−0.02	0.11
(f) Investor type					
Retail	4,037	0.70***	0.09**	0.04	0.13**
Institutional	2,771	0.59***	0.08	0.04	0.11
(g) Full sample (for comparison)					
All	6,207	0.68***	0.10**	0.03	0.16**

Table XIII: Alphas of winner- and loser-fund subgroups across different market cycles

This table presents monthly four-factor alphas of spread portfolios of winner- and loser-fund subgroups (in percentage points) based on independent sorts on absolute fund flows and manager change across different market cycles. See the note to Figure 1 for more explanation on the portfolio formation. The first column reports the unconditional four-factor alpha of the winner and loser funds, respectively. The second column reports the change in four-factor alphas between the formation and evaluation periods. The third and fourth columns report spreads between the subgroups conditional on net inflows and manager changes, respectively. The fifth column reports spreads between the subgroups conditional on net inflows and manager changes simultaneously. Panel (a) reports the results for winner funds and panel (b) for loser funds. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

(a) Winner funds

		Uncond.	Persistence	Single sorting		Double sort.
		Dec. 10	$\Delta\alpha_t$	Low − High	Without − With	Low w/o − High with
1992−2000	(Bull market)	0.13	-0.73^{***}	0.29^{***}	0.10	0.45^{***}
2001−2003	(Bear market)	−0.26	-1.46^{***}	0.15	−0.03	0.12
2004−2007	(Bull market)	−0.08	-0.65^{***}	−0.04	−0.02	−0.04
2008−2011	(Bear market)	−0.13	-0.81^{***}	0.09^{*}	−0.12	−0.03
Whole period		0.01	-0.81^{***}	0.15^{***}	0.01	0.19^{**}

(b) Loser funds

		Uncond.	Persistence	Single sorting		Double sort.
		Dec. 1	$\Delta\alpha_t$	Low − High	With − Without	Low with − High w/o
1992−2000	(Bull market)	−0.20	0.79^{***}	0.02	0.13^{*}	0.23^{*}
2001−2003	(Bear market)	-0.52^{***}	0.51^{***}	0.08	−0.08	0.04
2004−2007	(Bull market)	−0.09	0.80^{***}	0.08	0.02	0.10
2008−2011	(Bear market)	-0.19^{*}	0.43^{***}	0.15^{***}	−0.03	0.03
Whole period		-0.21^{**}	0.68^{***}	0.10^{**}	0.03	0.16^{**}

Table XIV: Classification of investment objectives

This table presents the classification codes we have used to construct our sample. We use Lipper codes, Wiesenberger codes and Strategic Insight codes where priority is given in this order if different codes assign funds to different investment categories.

	Lipper	Wiesenberger	Strategic Insight
Cap-based funds large-cap	LCCE, LCGE, LCVE, SP		
Cap-based funds mid-cap	MC, MCCE, MCGE, MCVE	GMC	
Cap-based funds small-cap	SCCE, SCGE, SCVE, SG, MR	SCG	SCG
Style funds growth	CA, G, MLGE	AGG, G, LTG, GRO, MCG	AGG, GRO, GRI, ING
Style funds growth and income	MLCE, GI	G-I, GCI, GRI, ING	
Style funds income	MLVE, EI, EIEI	IEQ, I[a]	OPI
Sector funds financial	FS	FIN	FIN
Sector funds health	H	HLT	HLT
Sector funds natural resources	NR	ENR	NTR
Sector funds technology	TK	TCH	TEC
Sector funds utilities	UT	UTL	UTI
Sector funds other	S, SESE, TL	GPM	ENV, RLE, SEC, GLD
Other	I	G-I-S, G-S, G-S-I, I-G, I-G-S, I-S, I-S-G, S-G, S-G-I, S-I-G, S-I	

[a] Note that Wiesenberger code I for income funds is not restricted to income equity funds but also contains income money market funds, income bond funds etc. Consequently we use a combination of Wiesenberger code I and policy code CS or I-S or Wiesenberger code I and an allocation to stocks of at least 50 percent as condition for funds to be included in our sample.